

A compact, desk-top near edge soft X-ray absorption fine structure spectroscopy system based on a laser plasma double stream gas puff target source

M. Duda^{*a}, P. W. Wachulak^b, A. Bartnik^b, A. Sarzyński^b, L. Wegrzynski^b, M. Nowak^b, H. Fiedorowicz^b, A. Jančárek^a, and L. Pina^a

^a Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University in Prague, Břehová 78/7, 115 19 Prague, Czech Republic

^b Institute of Optoelectronics, Military University of Technology, Kaliskiego 2, 00-908 Warsaw, Poland

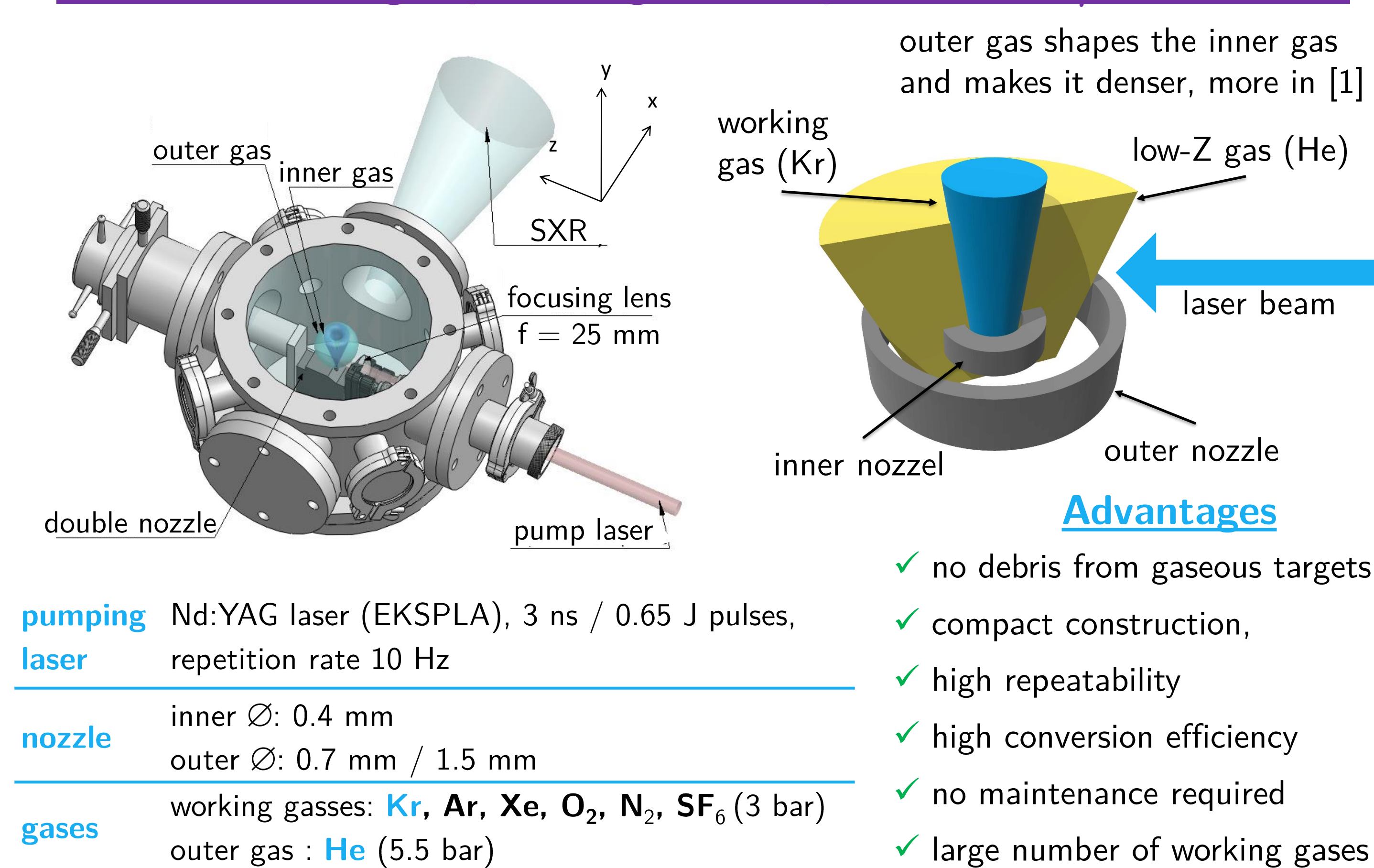
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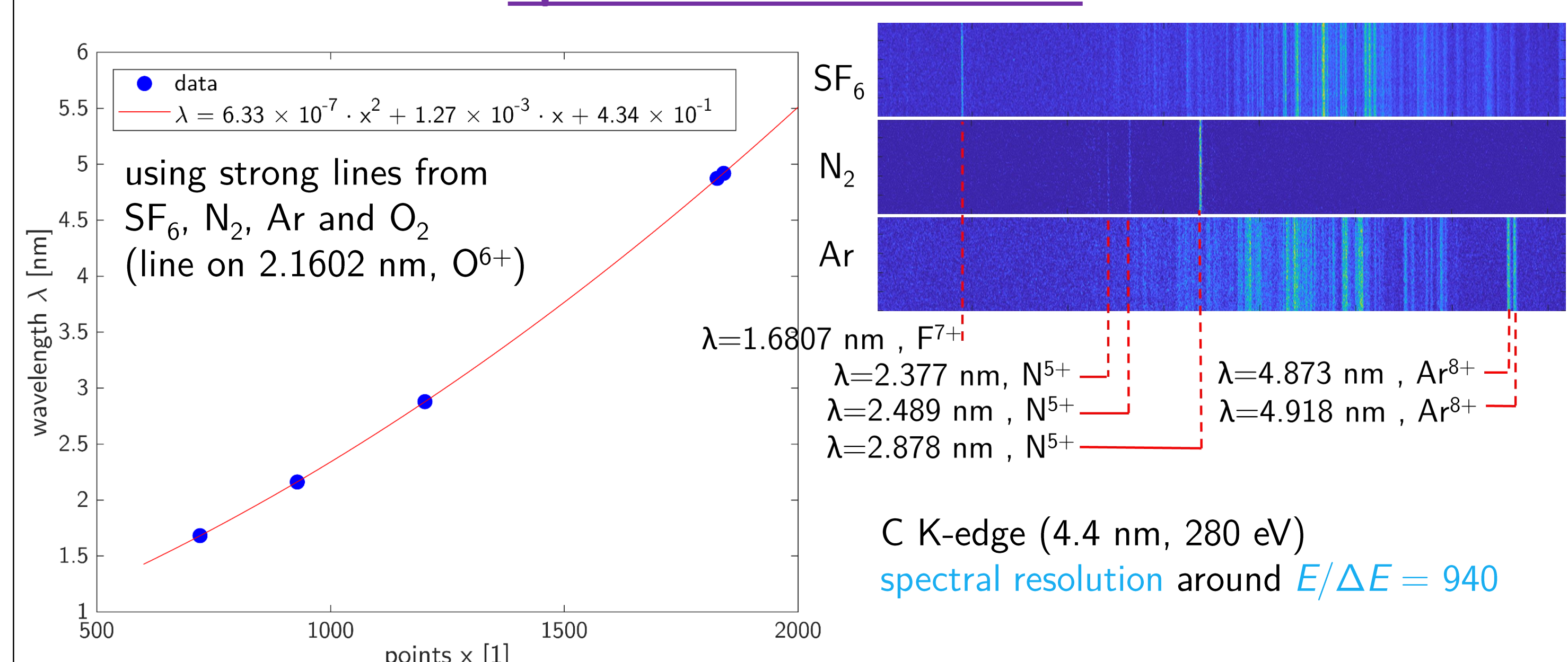
Abstract

A compact, desk-top, near edge soft X-ray absorption spectroscopy system was developed based on a laser-plasma source with double stream gas puff target. The krypton/helium plasma is formed by interaction of a laser beam with double stream gas puff target. The laser plasma source was optimized for efficient emission from 1.5 to 5 nm wavelength in the soft X-ray region. Such emission is used to acquire simultaneously spectra of soft X-ray light from the source and from the investigated sample using grazing incidence spectrometer. The measurements in transmission mode reveal the fine structures near the carbon K- α absorption edge of thin mylar film. The data are in agreement with synchrotron measurements. From those small features the composition of the sample was successfully obtained.

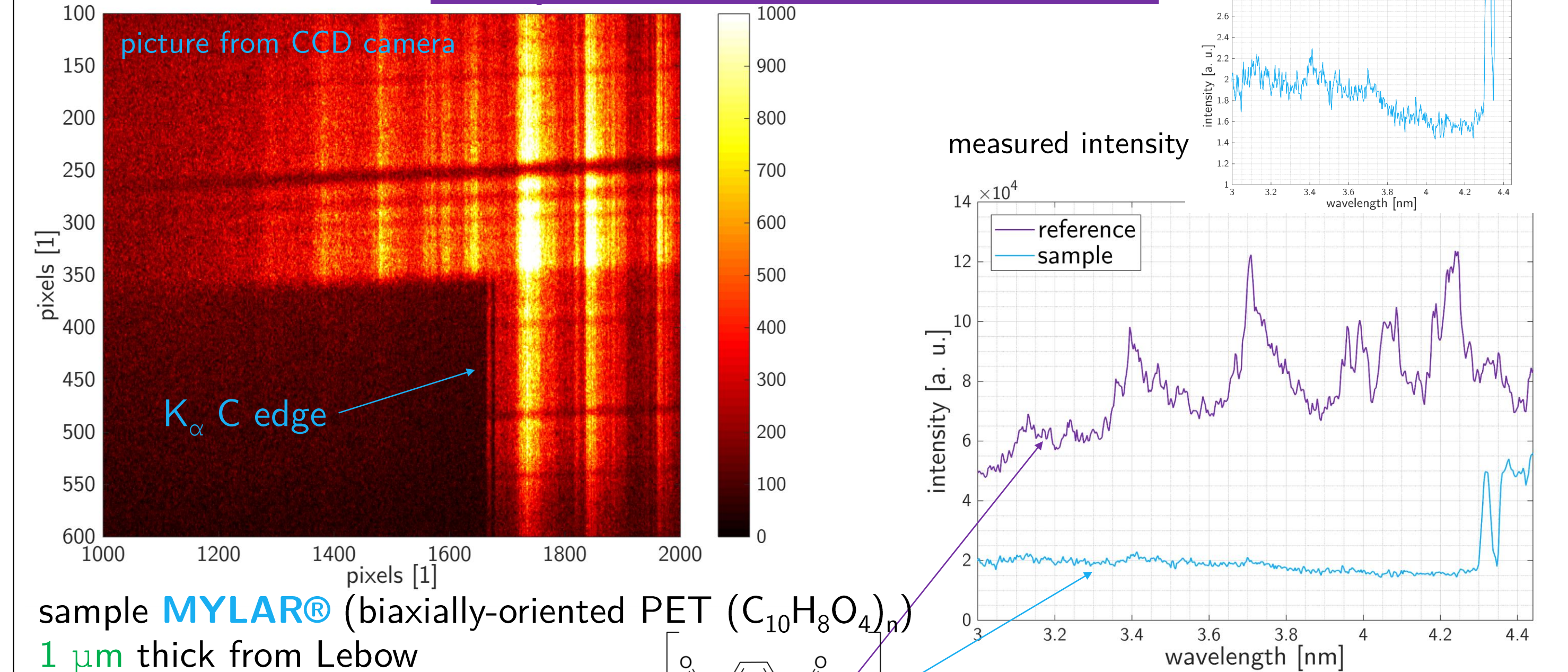
Double stream gas-puff target laser-plasma SXR/EUV source



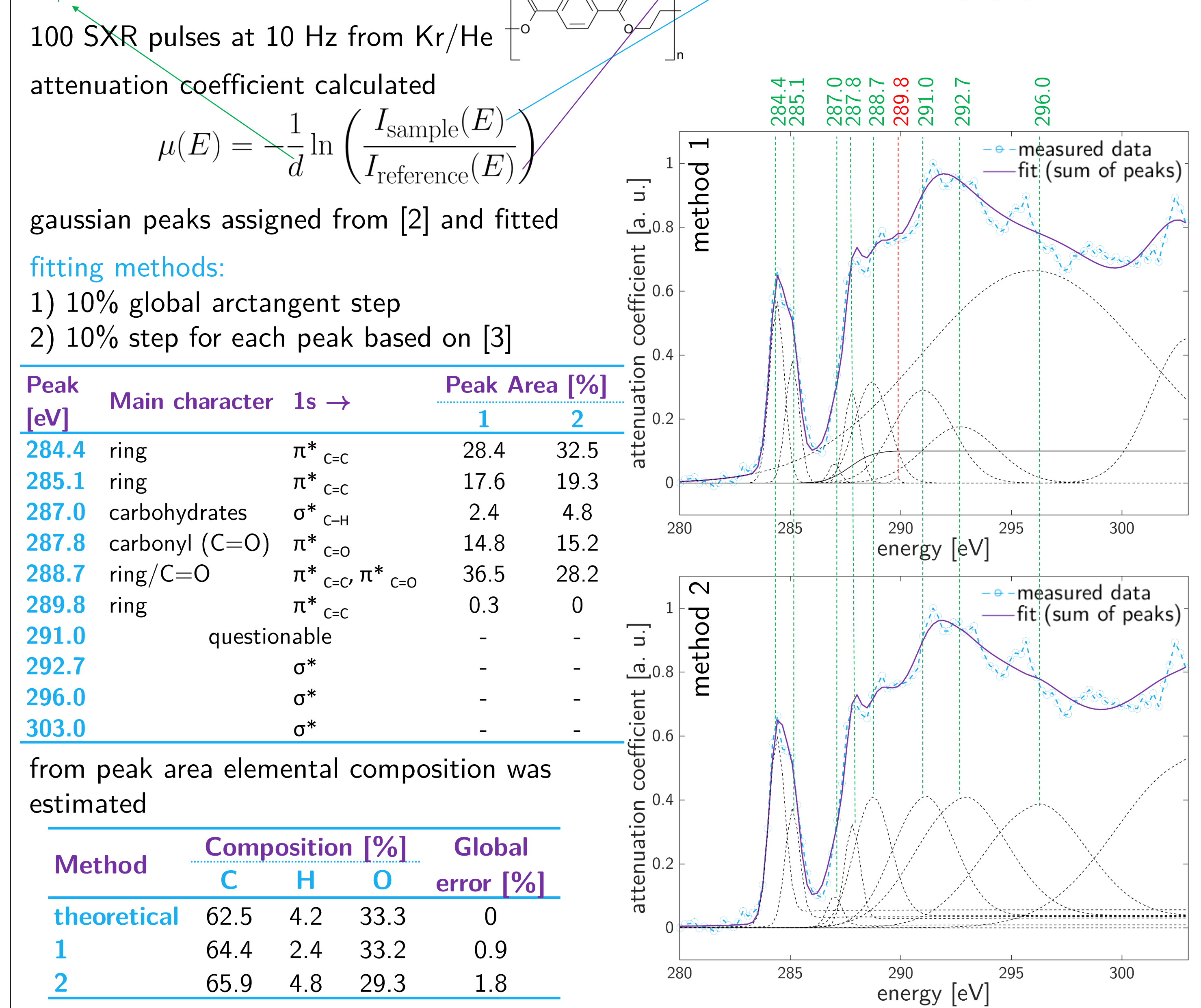
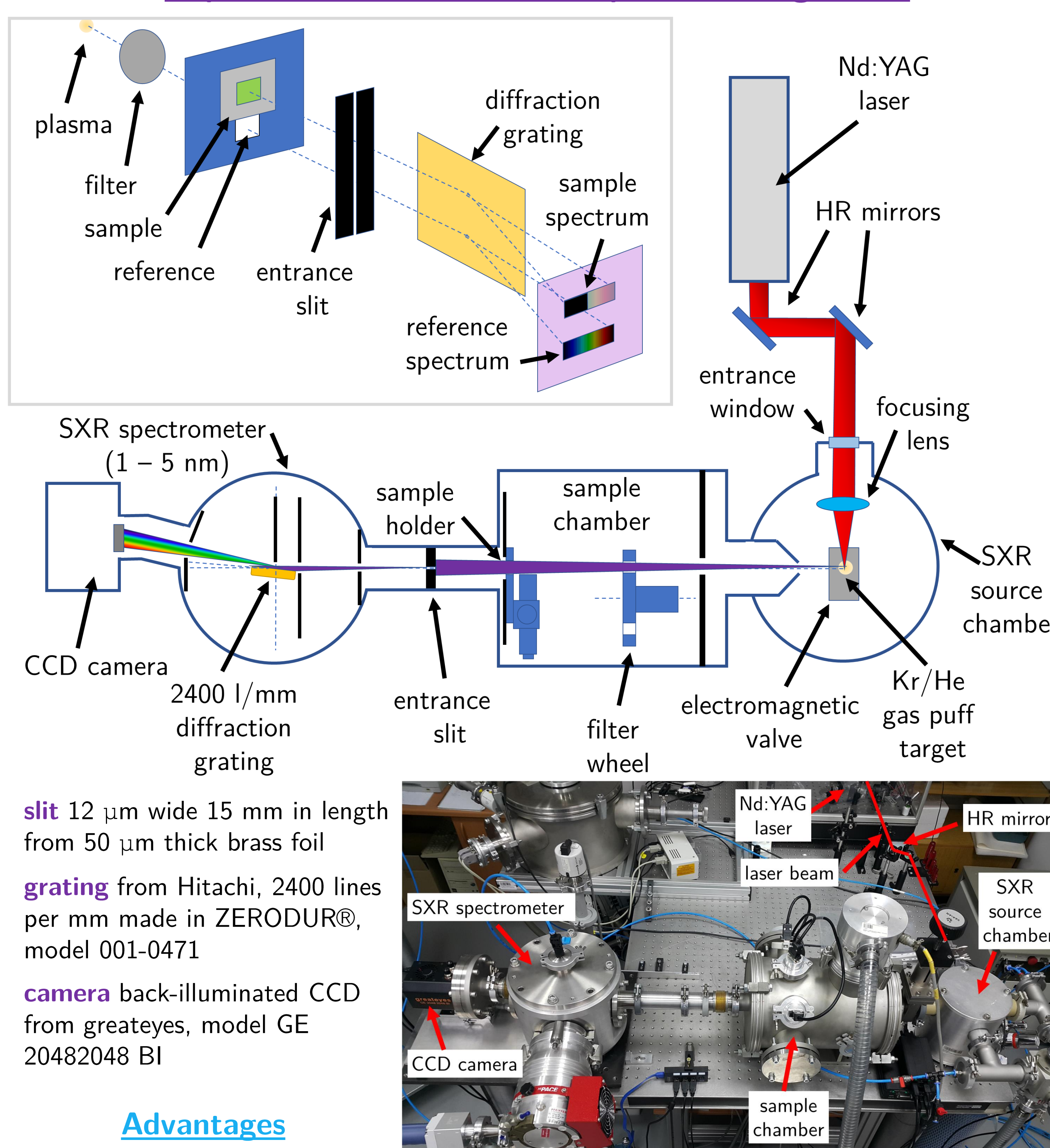
Spectrometer calibration



Sample NEXAFS measurement



Experimental scheme and optical arrangement



References

- [1] P.W. Wachulak, A. Bartnik, H. Fiedorowicz, T. Feigl, R. Jarocki, J. Kostecki, R. Rakowski, P. Rudawski, M. Sawicka, M. Szczurek, A. Szczurek, Z. Zawadzki, „A compact, quasi-monochromatic laser-plasma EUV source based on a double-stream gas-puff target at 13.8 nm wavelength”, Applied Physics B 100, 3, 461-469 (2010)
- [2] T. Okajima, K. Teramoto, R. Mitsumoto, H. Oji, Y. Yamamoto, I. Mori, H. Ishii, Y. Ouchi, and K. Seki, „Polarized NEXAFS Spectroscopic Studies of Poly(butylene terephthalate), Poly(ethylene terephthalate), and Their Model Compounds”, J Phys Chem A 102, 7093-7099 (1998)
- [3] J. Sedlmair, S. Gleber, Ch. Peth, K. Mann, J. Niemeyer, J. Thieme, „Characterization of refractory organic substances by NEXAFS using a compact X-ray source”, J Soils Sediments 12, 24-34 (2012)

Acknowledgements

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